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# Aqueous solution composition

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[Title of the Invention]

Aqueous solution composition

[Patent Claims]

(1) An aqueous solution composition for corrosion suppression, characterized by the fact that it is obtained by adding (a) an alkali metal hydroxide and (b) an antimony compound to an aqueous halide solution.

(2) The aqueous solution composition described under Claim 1, characterized by the fact that the (a) alkali metal hydroxide is lithium hydroxide and the (b) antimony compound is antimony trioxide.

(3) The aqueous solution composition described under Claim 1 or Claim 2, characterized by the fact that the concentrations of (a) the alkali metal hydroxide and (b) the antimony compound are 0.05-0.3 wt. % and 0.005-0.1 wt. %, respectively.

(4) The aqueous solution composition described under any of Claims 1-3, characterized by the fact that the halide is lithium iodide.

(5) The aqueous solution composition described under any of Claims 1-4, characterized by the fact that the halide is a combination of lithium iodide and lithium bromide.

(6) The aqueous solution composition described under any of Claims 1-5, characterized by the fact that the aqueous solution composition is an absorbing solution for absorption refrigerators [sic].

3. Detailed Description of the Invention

[Field in Industry]

The present invention relates to a noncorrosive aqueous solution composition, obtained by adding an alkali metal hydroxide and an antimony compound to a aqueous halide solution. In particular, it relates to an absorbing solution for absorption refrigerators [sic], containing lithium hydroxide and antimony trioxide.

[Prior Art]

Traditionally, in absorption refrigerators using an aqueous coolant, generally an aqueous halide solution is used as the absorbing solution. In particular, aqueous solution of lithium bromide is used. However, it is well known that lithium bromide aqueous solution causes corrosion for soft steel, copper, brass, etc. These metals are used in absorption refrigerators. When an aqueous lithium bromide solution is used as the absorbing solution in absorption refrigerators, it is necessary to add an inhibitor for corrosion prevention. Traditionally, generally used inhibitors include chromates, molybdates, tungstates, nitrites, nitrates, azole compounds, amine compounds, etc. Most of these compounds are oxidizing agents. They form a protective layer on the surface and thus suppresses corrosion. However, it has been difficult to completely prevent corrosion of all the different materials used for refrigerators. Moreover, in recent years, air-cooling type absorption refrigerators have been desired and developed. For such refrigerators, high concentration of absorbing solution and high temperature in the absorption refrigerator are required. In general, at high temperatures and concentrations, aqueous lithium bromide solutions cause more significant corrosion. Under such conditions, which are conducive to corrosion, the above inhibitors are not sufficient for suppressing the corrosion.

On the other hand, the composition of the absorbing solution has been widely modified, and various absorbing solutions suitable for the structure, functions, cooling conditions, etc. of refrigerators have been used. In some cases, lithium bromide is not used alone, but in combination with other compounds, and strict conditions for corrosion prevention are required. In particular, absorbing solutions containing lithium halide, such as lithium iodide, are highly corrosive. In such absorbing solutions, oxidizing agents, such as chromates, molybdates, nitrates, etc. are added as corrosion inhibitors. Due to these oxidizing agents, the iodide ion of lithium iodide (a component of the absorbing solution) is

oxidized and thus becomes free iodine. The presence of free iodine further facilitates metal corrosion. Thus, under such conditions, the traditional oxidizing agent inhibitors alone are not sufficient for preventing corrosion.

[Problems to be Solved by the Invention]

The objective of the present invention is to suppress corrosion of metallic materials of equipment, especially of absorption refrigerators, by including additives having high corrosion suppression effect against aqueous lithium iodide solution, in order to solve the above problem with aqueous solutions containing highly corrosive halide, in particular lithium iodide.

[Means of Solving the Problems]

The present aqueous solution composition is an aqueous solution composition for corrosion suppression, obtained by adding (a) an alkali metal hydroxide and (b) an antimony compound to an aqueous halide solution. In particular, (a) the alkali metal hydroxide is lithium hydroxide and (b) the antimony compound is antimony trioxide, and the concentrations of the alkali metal hydroxide and the antimony compound are preferably 0.05-0.3 wt. % and 0.005-0.1 wt. %, respectively. Specifically, if the concentration of the additive is too low, the suppressing effect is not significant. For lithium hydroxide and antimony trioxide, the minimal concentrations are 0.05 wt. % and 0.005 wt. %, respectively. Conversely, if the concentration is too high, the alkali itself may cause corrosion and solubility may also be a problem. Preferably the concentrations of lithium hydroxide and antimony trioxide are lower than 0.3 wt. % and 0.1 wt. %, respectively. The aqueous solution of halide is preferably that of lithium iodide or a combination of lithium iodide and lithium bromide.

The present aqueous solution composition is used as an absorbing solution for absorption refrigerators, which can inhibit corrosion of the metal materials.

[Mechanisms]

By adding antimony trioxide in an aqueous solution containing lithium halide, mainly the following two mechanisms occur. First, antimony trioxide acts as a reducing agent, reducing the oxidized halide ions and inhibiting the oxidation of halide ions. Second, antimony trioxide is adsorbed onto the surface of steel and copper materials in absorption refrigerators, forming a tight protective layer and hence preventing elution of iron and copper.

Moreover, lithium hydroxide also has excellent corrosion suppressing effect for lithium iodide, as well as for lithium bromide. Thus, the present invention is characterized by the addition of both lithium hydroxide and antimony trioxide.

[Practical Examples]

An aqueous solution containing a total of 63 wt. % of lithium bromide and lithium iodide was prepared. To this solution, various amounts of lithium hydroxide and antimony trioxide were added to prepare absorbing solutions of Practical Examples 1-4, as shown in Table 1. On the other hand, test sheets with a weight of 65.5 g and size of 11.0 cm (length) x 4.0 cm (width) x 0.2 cm (thickness) were prepared from carbon steel (SS-41 material). A hole for hanging was formed on the test sheet, and the surface of the sheet was ground with emery paper followed by degreasing. Five test sheets were immersed into each of the absorbing solutions of Practical Examples 1-4 containing various amounts of lithium hydroxide and antimony trioxide as shown in Table 1. Then, vacuum was created in the container, and heat treatment was performed at 185°C for 1000 hours. The weight change was measured to obtain corrosion loss. The results are shown in Table 1.

On the other hand, for comparison, in Comparative Example 1 no additive, in Comparative Example 2 lithium hydroxide and lithium molybdate, in Comparative Example 3 lithium hydroxide and lithium tungstate, and in Comparative Example 4 lithium hydroxide and lithium chromate were added. The results are shown in Table 2. From Table 1, which shows examples of the present invention and from Table 2, which shows comparative examples, it is clear that the aqueous solution composition obtained by adding lithium hydroxide and antimony trioxide as additives to aqueous lithium bromide and lithium iodide solution significantly reduced the corrosion loss of the carbon steel.

[Effect of the Invention]

The present aqueous solution composition is an aqueous solution obtained by adding a hydroxide of an alkali metal, in particular lithium hydroxide, and an antimony compound, in particular antimony trioxide, to an aqueous solution containing a halide. It exhibits anticorrosion effect for metallic materials. In particular, when the present aqueous solution composition is used as the absorbing solution for absorption refrigerators, there is little corrosion of the metallic materials. Thus, the present composition has excellent anticorrosion effect.

Table 1

| | | additive | addition amount (wt. %) | corrosion loss (mg/sheet) |
|---|---|---|---|---|
| Practical Example | 1 | LiOH<br>$Sb_2O_3$ | 0.07<br>0.029 | 31 |
| | 2 | LiOH<br>$Sb_2O_3$ | 0.14<br>0.029 | 22 |
| | 3 | LiOH<br>$Sb_2O_3$ | 0.07<br>0.058 | 25(not clear in original) |
| | 4 | LiOH<br>$Sb_2O_3$ | 0.14<br>0.058 | 16 |

Table 2

| | | additive | addition amount (wt. %) | corrosion loss (mg/sheet) |
|---|---|---|---|---|
| Comparative Example | 1 | -<br>- | -<br>- | 2893 |
| | 2 | LiOH<br>$Li_2MoO_4$ | 0.14<br>0.058 | 115 |
| | 3 | LiOH<br>$Li_2WO_4$ | 0.14<br>0.058 | 102 |
| | 4 | LiOH<br>$Li_2CrO_4$ | 0.14<br>0.058 | 132 |

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